

Subject Name:MECHATRONICS

Course: Diploma Engineering

Branch: Mechanical Engineering

Semester: 5TH

1.(A) What does mechatronics mean?

Ans. Mechatronics is a multidisciplinary field that refers to the skill sets needed in the contemporary, advanced automated manufacturing industry.

(B) What is a transducer?

Ans. A transducer is a device that converts energy from one form to another. Usually a transducer converts a signal in one form of energy to a signal in another.

(C) What is a sensor , explain with an example?

Ans. A device that responds to a physical stimulus (such as heat, light, sound, pressure, magnetism, or a particular motion) and transmits a resulting impulse (as for measurement or operating a control)

Example: Proximity sensor, Light Sensor

(D) Define Robotics.

Ans. Robotics involves design, construction, operation, and use of robots. The goal of robotics is to design machines that can help and assist humans. Robots can take on any form, but some are made to resemble humans in appearance.

2. (A) Differentiate between advantages & disadvantages of Mechatronics.

Advantages:

- 1. It is cost effective and it can produce high quality products.**
- 2. Production of parts and products of international standards gives better reputation and return.**
- 3. It serves effectively for high dimensional accuracy requirements.**
- 4. It provides a high degree of flexibility to modify or redesign the systems.**
- 5. It provides excellent performance characteristics.**
- 6. It Results in automation in production, assembly and quality control.**

Disadvantages:

1. The initial cost is high.
2. Maintenance and repair may be costly.
3. Multi-disciplinary engineering background is required to design and implement.
4. It needs highly trained workers to operate.
5. Techno-economic estimation has to be done carefully in the selection of the mechatronic system.

It has complexity in identification and correction of problems in the systems.

(B) Difference between Position Sensor & Motion Sensor.

Ans. Position Sensor: Position sensor is a device that can detect the movement of an object and converts these into signals suitable for processing, transmission, or control.

Motion Sensor : A motion sensor (or motion detector) is an electronic device that is designed to detect and measure movement.

(C) What are the 3 laws of robotics in I robot?

Ans. First Law: A robot may not injure a human being or, through inaction, allow a human being to come to harm.

Second Law: A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.

Third Law: A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

3. (A) What is the classification of transducers?

Ans. Primary and Secondary Transducer: Suppose you need to measure pressure. In this case we use bourdon tube .so bourdon tube act as primary transducer; it senses the pressure and converts pressure into displacement of its free end. The displacement of free end moves core of linear variable differential transducer which produces output voltage proportional to movement of core which is proportional to movement of core which is again proportional to

pressure. So we are able to measure pressure. Here bourdon tube is primary transducer and LVDT is secondary transducer.

Analog and Digital Transducer: Transducers converting input quantity to analog output in form of pulses are analog transducers. I.E. Strain gauge, thermocouple etc. digital transducers convert input to electrical output in form of pulses.

Active and Passive Transducer: Active transducers are those which don't need auxiliary power source to produce output. The energy required for production of output signal is obtained from physical quantity being measured. I.E. piezoelectric crystals, tacho-generators etc. Passive transducers are those which need an auxiliary power source to produce output. I.E. linear potentiometer etc.

Transducers and Inverse transducer: Transducers, as mentioned earlier convert non electrical quantity to electrical quantity whereas inverse transducer converts electrical to non-electrical quantity. This type of transducer convert electrical signal in to required form. I.E. Piezoelectric Crystal. It converts electrical signal in to mechanical vibration.

(B) Explain Velocity, motion, force and pressure sensors.

Ans: Velocity Sensors: A velocity receiver (velocity sensor) is a sensor that responds to velocity rather than absolute position. ... Movement causes the coil to move relative to the magnet, which in turn generates a voltage that is proportional to the velocity of that movement.

Motion Sensors: A motion sensor (or motion detector) is an electronic device that is designed to detect and measure movement.

Force Sensors: A Force Sensor is defined as a transducer that converts an input mechanical load, weight, tension, compression or pressure into an electrical output signal (load cell definition). Force Sensors are also commonly known as Force Transducers.

Pressure Sensors: A pressure sensor is an instrument consisting of a pressure sensitive element to determine the actual pressure.

(C) State and explain types of industrial robots

Ans: Cartesian Robots: Cartesian robots, which are also called linear robots or gantry robots, are industrial robots that work on three linear axes that use the Cartesian Coordinate system (X, Y, and Z), meaning they move in straight lines on 3-axis (up and down, in and out, and side to side).

SCARA Robots: SCARA is an acronym that stands for Selective Compliance Assembly Robot Arm or Selective Compliance Articulated Robot Arm. SCARA Robots function on 3-axis (X, Y, and Z), and have a rotary motion as well.

Articulated Robots: Articulated Robots mechanical movement and configuration closely resembles a human arm. The arm is mounted to a base with a twisting joint. The arm itself can feature anywhere from two rotary joints up to ten rotary joints which act as axes, with each additional joint or axis allowing for a greater degree of motion.

Cylindrical Robots : Cylindrical Robots have a rotary joint at the base and a prismatic joint to connect the links. The robots have a cylindrical-shaped work envelope, which is achieved with a rotating shaft and an extendable arm that moves in a vertical and sliding motion.

Delta Robots : Delta Robots, or parallel robots, possess three arms connected to a single base, which is mounted above the workspace. Delta Robots work in a dome-shape and can move both delicately and precisely at high speeds due to each joint of the end effector being directly controlled by all three arms.

Polar Robots: Polar Robots, or spherical robots, have an arm with two rotary joints and one linear joint connected to a base with a twisting joint. The axes of the robot work together to form a polar coordinate, which allows the robot to have a spherical work envelope.

Collaborative Robots: Collaborative Robots or Cobots are robots that can directly and safely interact with humans in a shared workspace.